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EXAMINER	
ZERVIGON, RUDY	
ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 12/06/2001

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.
09/055,201

Applicant(s)
Br wn, W., Herchen, H., Welch, M.D.

Examiner
Rudy Zervigon

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- The MAILING DATE of this communication appears on the cover sheet with the correspondenc address -

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on Sep 20, 2001

2a) ☐ This action is FINAL.

2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 35 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) 1-11, 14, 15, 24, and 26-78 ³ ~~75-78~~ is/are pending in the applica

4a) Of the above, claim(s) _____ is/are withdrawn from considera

5) ☒ Claim(s) 10, 11, 14, 15, 24, 26-30, 33-36, 40-73, and 75-78 is/are allowed.

6) ☒ Claim(s) 1-6, 8, 9, 31, 32, and 74 is/are rejected.

7) ☒ Claim(s) 7 and 37-39 is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirem

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)

18) ☐ Interview Summary (PTO-413) Paper No(s). _____

16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

19) ☐ Notice of Informal Patent Application (PTO-152)

17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____

20) ☐ Other:

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DETAILED ACTION

Continued Prosecution Application

1. The request filed on September 20, 2001 for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 09/055,201 is acceptable and a CPA has been established. An action on the CPA follows.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 2, 6, 9, 31, and ~~74~~ are rejected under 35 U.S.C. 103(a) as being unpatentable over Randall S. Mundt (U.S.Pat. 5,137,701) in view of Uhm (U.S.Pat. 5,468,356). Randall S. Mundt describes an apparatus and method for eliminating unwanted materials from a gas flow line (title). The apparatus of which can be used to treat effluent gas from semiconductor processes (column 1, lines 22-24; column 2 lines 66-68; column 3, lines 1-2; column 4, lines 64-68). Specifically, Randall S. Mundt describes a process chamber (12; column 2, lines 64-68) for processing a substrate (column 2, lines 64-68; column 8, lines 40-45) in a process gas and reducing emissions of hazardous gas to the environment (abstract). Randall S. Mundt additionally describes the process chamber (column 8, lines 40-45) where for processing a substrate on a substrate support and a gas distributor capable

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of introducing process gas into the process chamber (column 2, lines 64-68; column 8, lines 40-45). Additionally, Randall S. Mundt teaches a gas activator (column 2, lines 64-68; column 8, lines 40-45). Randall S. Mundt also teaches a reagent gas mixer capable of mixing a reagent gas with the effluent (column 3, lines 3-18).

Randall S. Mundt also describes an exhaust tube (18) through which the effluent may be flowed. The exhaust tube having an internal flow surface (82) substantially free of projections or recesses that alter the flow direction of the effluent through the exhaust tube.

Randall S. Mundt also describes a distributor plate (74 Fig.3) having holes (column 8, lines 1-11) adapted to direct effluent preferably along the internal flow surface of the exhaust tube.

Randall S. Mundt also describes a microwave energy applicator (column 3, line 49 - column 4, line 11) to couple microwaves to the effluent flow through the exhaust tube to reduce the hazardous gas content of the effluent (column 2, lines 64-68; column 8, lines 40-45).

Randall S. Mundt also teaches an exhaust tube with a length sufficiently long to reduce the hazardous gas content of a continuous stream of effluent flowing through the exhaust tube without recirculating the effluent (column 6, lines 23-27).

However, Randall S. Mundt does not teach an exhaust tube that is adapted to provide "a non-circuitous and non-turbulent flow of effluent therethrough" and this exhaust tube being substantially absent of projections or recesses "that cause turbulence in the flow of the effluent through the exhaust tube".

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Uhm teaches microwave flue gas treatment as substantially claimed (column 2, lines 3-14). Additionally, Uhm teaches an exhaust tube (22, Figure 2) that is adapted to provide "a non-circuitous and non-turbulent flow of effluent therethrough" (column 2, lines 15-31). Uhm is silent with respect to the exhaust tube being substantially absent of projections or recesses "that cause turbulence in the flow of the effluent through the exhaust tube".

It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the Uhm exhaust tube adapted to provide "a non-circuitous flow of effluent therethrough".

Motivation for implementing the Uhm exhaust tube adapted to provide "a non-circuitous flow of effluent therethrough" in place of the Randall S. Mundt exhaust tube (18) is drawn to the benefits of the Uhm apparatus over that of the prior art including better uniformity of operation, better control, improved energy efficiency, and more compactness and simplicity (column 1, lines 20-30).

4. Claims 3, 8, 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Randall S. Mundt (U.S.Pat. 5,137,701) in view of Uhm (U.S.Pat. 5,468,356) as applied to claims 1, 2, 6, 9, and 31 above, and further in view of Kin-Chung Chiu (U.S. Pat. 4,735,633). Randall S. Mundt does not make specific reference to a residence time in the processing reactor of the gas to be treated. Additionally, Randall S. Mundt does not make specific reference to an RF energy applicator coupling RF energy to the exhaust tube.

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Chiu discloses an exhaust system apparatus, plasma extraction reactor (lines 66-68, column 2), for treating effluent gas streams from plasma processes (Figures 1-6). Chiu specifically applies the plasma extraction reactor to remove vapor phase environmental contaminants from effluent gas streams generated by semiconductor processing equipment generating plasma states (line 61-68, column 2). Chiu also discloses the location of his plasma extraction reactor relative to a CVD process (lines 1-18, column 6).

Chiu's exhaust system apparatus also make use of an RF energy applicator coupling RF energy to the exhaust tube (column 6, lines 59-63).

According to the following demonstration, the requirement that the flow path be of sufficient length to provide an effluent gas residence time of at least 0.01s in the exhaust plasma extraction reactor stipulated in claim 3 is implicitly satisfied under the teachings of Chiu¹.

A person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the Randall S. Mundt baffle geometry by altering its relative dimensions to resemble the Kin-Chung Chiu baffle system and, thus, as was demonstrated in the Examiner's calculations sheet

¹Refer to the Examiner's calculation sheet.

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(provided as an attachment to the first Office Action) provide residence time of the effluent flowing through the exhaust tube that is at least about 0.01 seconds.

Motivation for altering the geometry of the Randall S. Mundt effluent gas reactor according to the Kin-Chung Chiu design parameters is for allowing sufficient time for the contaminants to react (column 3, lines 24-45).

A person of ordinary skill in the art at the time the invention was made would have found it obvious to add the Chiu RF energy applicator coupling RF energy to the exhaust tube (column 6, lines 59-63) to the Randall S. Mundt effluent treatment device as motivated by Chiu's removal efficiencies (column 9, lines 14-28).

5. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Randall S. Mundt (U.S.Pat. 5,137,701) in view of Uhm (U.S.Pat. 5,468,356), as applied to claims 1, 2, 6, 9, and 31 above, and further in view of Kin-Chung Chiu (U.S. Pat. 4,735,633). Randall S. Mundt does not make specific reference to the flow regime (turbulent or laminar) in the processing reactor of the gas to be treated.

Variations on contact area of the reacting effluent are considered and integrated into the design by altering the geometry of the flow path (lines 24-45, column 3). Among the geometric design considerations of the internal flow chamber put forth by Chiu include a flow path length to ensure sufficient removal of the effluent gas (lines 24-30, column 3), a high ratio of electrode area to

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reactor volume (lines 11-23, column 3), electrode surface area to flow rate of gas to be optimally set for vapor removal capacity (lines 30-37, column 3). Although Chiu does not explicitly make reference to the flow regime, either turbulent or laminar, when passing the effluent gas through the plasma extraction reactor. Chiu also does not explicitly make reference to the surface characteristics of the flow path. However, because Chiu discusses variations of the internal flow chamber geometry as well as flow characteristics of the effluent gas in the range of values outlined in lines 8-45 column 3 Chiu is implicitly favoring laminar, unhindered, flow of the effluent gas through his plasma extraction reactor. Any author describing internal fluid flow, such as Chiu, would consider that the direction of fluid flow (velocity vector), substantially distant from the boundary layer, and the tangent to the surface of the encasement are an implicitly parallel. Chiu does point out that in order to reduce the size of his plasma extraction reactor, the processing pipe can be convoluted (lines 57-62, column 4) as apposed to the larger processing space required for a linear plasma processing apparatus. Projections or recesses, beyond boundary layer variability, are also implicitly taught by Chiu under the observation that the geometric design considerations of the internal flow chamber and flow rates for sufficient removal put forth by Chiu (lines 11-37, column 3) would have to be reinvestigated/recalculated if projections or recesses were present in Chiu's plasma extraction reactor. Figures 1-6 also support flow surfaces absent of projections and or recesses.

A person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the Randall S. Mundt baffle geometry by altering its relative dimensions to resemble the

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Kin-Chung Chiu baffle system and thus provide for laminar flow in the processing tube. Motivation is provided by Randall S. Mundt's discussion of flow rate ratio to electrode area (column 3, lines 30-45).

Allowable Subject Matter

6. Claims 7, and 37-39 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

7. Claims 10, 11, 14, 15, 24, 26-30, 33-36, 40-73, and 75-78 are allowed.

8. The following is a statement of reasons for the indication of allowable subject matter: Independent claims 10, 11, 26, and 28 are allowed because none of the cited references provide the claimed conditions of operation of the microwave energy applicator coupling microwaves to the effluent and thereby energizing the exhaust gases in the exhaust tube as provided by the computer controller.

Independent claim 24 is allowed because the amended claim distinguishes from the closest related art, by Randall S. Mundt (U.S.Pat. 5,137,701), in the following point:

- i. The exhaust tube (22, 24, 18, 30; Figure 1) through which the effluent may be flowed is *not* described as being fabricated from monocrystalline sapphire

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Response to Arguments

9. Applicant's arguments filed September 27, 2001 with respect to claims 1-6, 8, 9, 31, 32, and 74 have been considered but are not persuasive.

10. With regards to the telephone conversation discussing the newly discovered art to Uhm (applied in this action - U.S.Pat. 5,468,356), the Examiner believes, as per the above rejections that Uhm's "metal fragments" (24) are optionally installed as per the Uhm discussion (column 3, lines 23-25).

11. That Uhm "does not teach a process chamber for processing a substrate" is agreed to by the Examiner, however, as discussed above, Randall S. Mundt (U.S.Pat. 5,137,701) meets such a deficiency of the Uhm patent.

12. That Uhm "does not teach or make any suggestion that such an apparatus is capable of reducing hazardous gas emissions from a substrate processing chamber, especially because gases are typically maintained at sub-atmospheric pressures in such chamber." is not accurate especially when the claims in question are directed to an apparatus whose use is anticipated if the prior art reference meets the claimed components. See MPEP 2114. Additionally, the argument that emitted gases from the substrate chamber are under vacuum is sufficient for patentability is not persuasive. Again, when the claims in question are directed to an apparatus whose operation is anticipated if the prior art reference meets the claimed components. See MPEP 2114. More over, Mundt provides support for each of the stated arguments as provided above.

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Conclusion

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 872-9311. The official before final fax phone number for the 1763 art unit is (703) 872-9310. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (703) 308-1633.


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